

AD-A080 375

FORECASTING INTERNATIONAL LTD ARLINGTON VA

F/6 5/2

INITIAL CONCEPTUALIZATION AND CHARACTERIZATION OF A NAVY AUTOMA--ETC(U)

JAN 80 N NISENOFF, A CLAYTON

N60921-79-C-0106

NL

UNCLASSIFIED

1 of 1

AD-A080375

END

DATE

FILED

3-80

DDF



**INITIAL CONCEPTUALIZATION AND CHARACTERIZATION
OF A
NAVY AUTOMATED PUBLISHING SYSTEM**

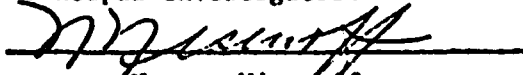
Volume 1. Executive Summary

January, 1980

**Prepared Under Contract Number N60921-79-C-0106
for**

**Naval Surface Weapons Center
White Oak, Silver Spring, Maryland**

Principal Investigator:


Norman Nisenoff

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle)		5. TYPE OF REPORT & PERIOD COVERED
Initial Conceptualization and Characterization of a Navy Automated Publishing System, Volumes 1,2,3. Volume 1, Executive Summary.		Final 2/15/79 - 11/15/79
6. AUTHOR(s)		7. PERFORMING ORG. REPORT NUMBER
Norman/Nisenoff Audrey/Clayton		
8. CONTRACT OR GRANT NUMBER(s)		
		N60921-79-C-0106
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
Forecasting International, Ltd. 1001 North Highland Street, P. O. Box 1650 Arlington, Virginia 22210		62760N; 0; F53531; CE35HA.
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE
Naval Surface Weapons Center White Oak, Silver Spring, MD 20910 Attn: Code E35		Jan 1980
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES
		Volume 1: 27
		15. SECURITY CLASS. (of this report)
		Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)		
Approved for public release; distribution unlimited.		
Final rept. 15 Feb - 15 Nov 77		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
Automation Printing and publishing Navy non-tactical information Information resource management Information dissemination Distributed systems		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
This report describes an R&D study whose objective was the characterization of an automated publishing system for the Navy which could be introduced during the early 1980s and evolve incrementally to meet by the year 2000 the Navy's needs with regard to the publication of all non-tactical information. Both the methodology and the conclusions of the project are included in the 3-Volume report, together with recommendations for Navy actions to develop and test further the concept of such a system.		

FOREWORD

This report is submitted to the Naval Surface Weapons Center (NAVSWC) in compliance with the requirements of Contract Number N60921-79-C-0106 under which Forecasting International, Ltd. (FI) has studied the potential of advanced technology to assist the Navy Publications and Printing Service (NPPS) in the fulfillment of its mission. The project was funded by the Naval Supply Systems Command (NAVSUP) under the auspices of its Automated Graphic Sciences (AGS) program. The intent of the study was to conceptualize an automated publishing system for the Navy which could be introduced during the early 1980s and evolve incrementally to meet the Navy's needs, with regard to information designated for publication, by the year 2000. The effective date of this contract was February 15, 1979. See Appendix A for administrative project history.

Accession For	
NTIS	GR11
DDC TAB	
UNCLASSIFIED	
Justification	
By	
Date	
A	

ABSTRACT

✓ There are many inadequacies in current Navy printing and publishing capabilities, and potential for improvement is offered by rapidly advancing computer and communications technologies. This report details the findings of a research and development program conducted by Forecasting International Ltd. to provide the Navy Publications and Printing Service with an automated system concept to address these shortcomings.

The Navy Automated Publishing System (NAPS) concept here described is intended to be introduced initially in the early 1980s, and evolve incrementally to meet, by the year 2000, the Navy's needs with regard to the publication of all non-tactical information. This 3-volume report presents a description of the methodology employed; a review of Navy needs in this time frame; a detailed discussion of the state-of-the-art in pertinent technologies and a forecast through the period of concern; and a broad conceptualization of both the year 2000 system and the incremental steps for its achievement. Recommendations for Navy actions to develop and test further the concept of such a system are also included.

↖

TABLE OF CONTENTS

	<u>Page</u>
Volume 1. EXECUTIVE SUMMARY	
FOREWORD	
ABSTRACT	
1. The Problem	1
2. Potential Approaches to a Solution	4
3. Proposed NAPS Concept	7
3.1 Introduction	7
3.2 NAPS 2000	12
3.2.1 Introduction	12
3.2.2 Text Handling	12
3.2.3 Graphics Handling	15
3.3 The Route to NAPS 2000	17
3.3.1 Introduction	17
3.3.2 Input	19
3.3.3 Processing	19
3.3.4 Mass Storage	20
3.3.5 Communications	21
3.3.6 Output	21
4. Conclusions	22
5. Recommendations	23
6. References	26
Volume 2. TECHNICAL REPORT	
Volume 3. APPENDICES	

LIST OF EXHIBITS
(Volume 1)

<u>Exhibit No.</u>	<u>Title</u>	<u>Page</u>
1.	Typical Technical Manual Growth	3
2.	Advances in Applicable Technologies	8
3.	Percentage of Electronic Printer Copy Volume Produced by Various Technologies	9
4.	Survey Responses Concerning Percentage of Technical Reports Produced in Machine Readable Form	10
5.	NAPS 2000	13
6.	Idealized Interaction Among Events, State of the Art, Requirements and NAPS	18

EXECUTIVE SUMMARY

1. The Problem

Billions of pages of material are published within the Navy each year. The actual total is not known, but even for the limited segment where such data are available, over \$100 million per annum is spent on Navy publication, both internally produced and contracted to the printing industry, and a further \$100 million is spent annually on reprographics. A recent estimate by Hughes Ground Systems Group as part of a Navy-funded study¹ quoted the value of the Navy inventory of technical manuals alone as about \$5 billion, although this includes content-generation. In addition to maintenance, operational and training documents, a large mass of published material is generated for administrative purposes: such items as instructions, reports, periodicals, forms, etc. Subsequent to the original printing, more than one billion copies (pages) per year² are made on Navy copiers.

The growing volume of Navy publications, and the ever faster-growing demand for such documentation, are outstripping the resources available for its preparation, production, storage, distribution and control. The problems are exacerbated by the proliferation of media (paper, microform, electronic, audio/visual) and increased diversity of forms and formats, which are reflected both in complexities of updating, tracking, storage and retrieval, and in decreasing productivity of the printing and publishing sector. A recent report³ on productivity in various sectors of the Federal Government demonstrated sharply the contrast between increased costs and decreased productivity in printing and duplicating activities, and conversely, decreased costs and increased productivity in high technology areas such as communications. According to this survey, between 1967 and 1977 the average annual rate of change in output per employee year was +1.3% overall, and +9.2% for the communications

function, as compared to -1.7% for government-wide printing and duplication. Over the same period, unit labor cost for government-wide printing and duplication rose by 11.1% annually, on average, compared to 7.2% overall, and a decrease of 1.1% in the communications segment.

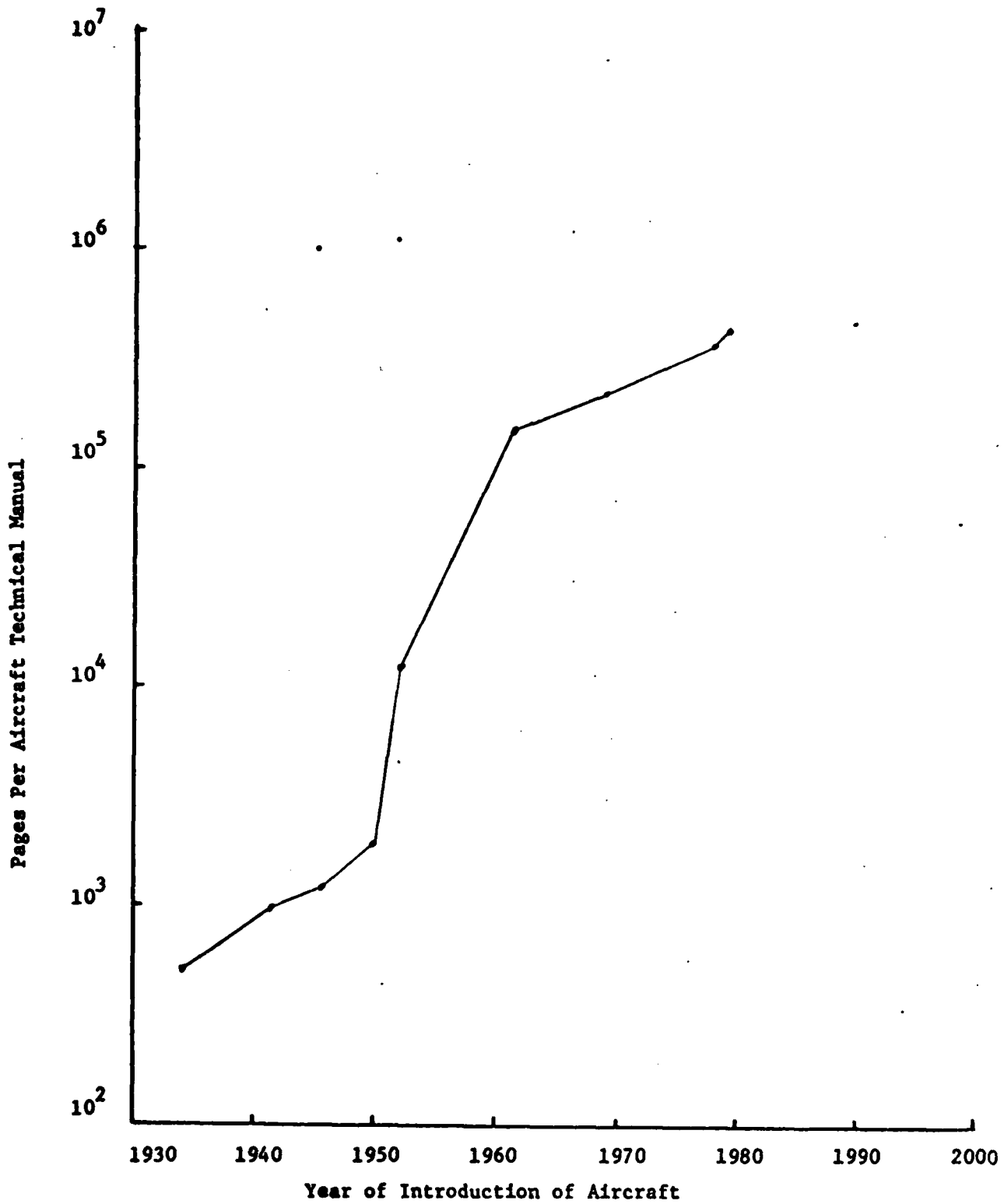
The resultant shortcomings in publishing services are particularly evident in the provision of accurate and timely technical information. The increasing sophistication of weapons systems and ancillary equipments results in greater quantities of documentation for training, maintenance and operation; Exhibit 1 reflects this increase in terms of the number of pages per aircraft technical manual over the past forty years.⁴ This places a heavy and ever-increasing burden on the technician; the estimated time spent by maintenance personnel in seeking information in 1977 was 30%,⁴ compared to 10% in 1967.⁵ The trend is reinforced by the recent decrease in number and intellectual caliber of Navy recruits which requires the provision of more detailed information for these same tasks, and this again increases the volume of material to be published. Other forces serving to increase publication quantity are the overall increase in bureaucratic regulation and consequent documentation; the all-volunteer force, with its heavier burden of recruiting materials; lack of production standards, and consequent failure to take advantage of space-saving composition; and the wastage due to stockpiling and subsequent obsolescence when updating or replacement is necessary.

At the same time, personnel limitations in terms of quantity and quality affect the provision of satisfactory printing services afloat and, to a lesser extent, in shore support facilities.

One of the most serious aspects of this publication overload is its lack of definition: there is no useful existing categorization of published materials which is accepted Navy-wide which, with accompanying volume/cost data, could form the basis for

EXHIBIT 1

TYPICAL TECHNICAL MANUAL GROWTH



accountability. Government-wide action is being taken to address these deficiencies, as evidenced⁶ by recent directives emphasizing the need for information resource management at the Agency/Department level.

The costs of publication-related manpower, materials and storage, and the dissatisfaction over delays in the provision of required publications and current information, make it mandatory that the Navy utilize any available approach to optimize the life-cycle cost-performance of its publishing activities. The Navy Publications and Printing Service (NPPS) is the central printing and publications management organization of the Navy, as chartered by the Joint Committee on Printing (JCP). In fulfillment of this charter, it has consequently embarked upon a program of productivity enhancement by the application of advanced technology, an approach of proven efficacy in other areas: between 1950 and 1975 U.S. industrial productivity improved by about 90% compared to only 4% in office-type activities,⁷ a difference probably resulting in part from the extent to which automation has been applied.

This report shows how automation can contribute to fulfilling the NPPS goal of providing responsive and cost-effective publishing services to the Department of the Navy.

2. Potential Approaches to a Solution

The problems discussed in the preceding section are by no means unique to the Navy. It is of interest to see how they have been approached in the private sector, and two prime examples are provided by newspaper/magazine publishing, and by the aerospace industry. In both instances, the trend has been toward the widespread introduction of automation and electronic text processing techniques, taking advantage of demonstrated rapid increase in speed and capabilities together with dramatic reduction in overall life-cycle cost. The potential benefits of such automation were emphasized in a recent report⁸ from the Naval Education and Training Command (CNET) Training Analysis and Evaluation Group (TAEG) which demonstrated the substantial savings in paper and printing costs, amounting to over a million dollars in the first year.

The vast majority of newspapers in the U.S., and a growing

number of weekly magazines, are now published electronically. News stories are keyed in directly by their authors (reporters), and the electronic chain (the automatic transfer of the information captured by these keystrokes) continues through to the composition and phototypesetting of composed galley. Full-page composition for magazines includes all illustrations, as well as electronic transmission for typesetting at remote printing facilities. For U.S. News and World Report (USNWR), since 1977, all line art, half-tones and screen tint backgrounds (including colored screens and spot color) have been digitized and stored in the text processing computer (an Atex system). Pages are typeset at the USNWR offices for proof purposes. Pages to be printed are transmitted to remote printing plants where the complete pages are "typeset" on film which is used to make printing plates. USNWR did not, in early 1979, use interactive graphic display tubes to speed the process of assembling the elements to appear on a page -- but this should come before the middle of 1980. Nor does it yet digitize and transmit color separations -- but this will come within the next few months.

In early 1979, because of the cost of the equipment used to digitize pictures and artwork, and the cost of the digital storage required to accomodate digitized graphics, the USNWR approach made sense only in situations in which there is a high value to be gained by transmitting complete pages in digital form. However, there is little doubt but that as the technology improves an increasing number of firms will find that it pays to handle graphics in digitized form -- especially if they expect to be able to output complete pages directly to an electronic printer or a laser plate-maker.

In the case of both U.S. News and World Report and the New York Times, a major benefit has accrued from secondary use of data bases originally introduced as a consequence of automated publishing operations. The technological development of trillion-bit computer memories, which can store entire libraries (or at least, whole sections of libraries), better access methods, the growing network of interconnected computer-communication networks, the local usage of personal computers with CRT displays rather than 'dumb' hardcopy terminals for reading, optical disks for local storage, and speedy

THIS PAGE IS BEST QUALITY PRACTICE
... ..

hardcopy printer systems, together point to the real possibility of a national or international system of full-text files. Libraries could move from their traditional role as storehouses of materials to become dynamic nodes in information networks. This consideration is of major significance also for the NAPS concept, as will be emphasized in subsequent discussion.

Skilled composition, whether or not the process is automated, can achieve substantial space savings, but there is a trade-off in cost effectiveness when the task is performed manually. CNET has estimated⁸ that a compression factor of 2:1 can be achieved by automated composition. In the aerospace industry, production of supporting documentation has been automated by the contractors who supply weapons systems to the Navy. At present this is of benefit to the contractor rather than to the Navy. Each contractor produces documentation conforming to his own format and medium, within certain wide bounds, and the Navy struggles to control the resultant diverse set of publications. The definition and institution of interfaces between contractor publication processes and the Navy's printing and publishing system is essential to achieving increased responsiveness to the Navy's needs for technical information.

Even within the Navy, the Command-specific (non-NPPS) printing and publishing capabilities are fairly sophisticated and make considerable use of automated composition for limited applications. Facilities such as TRUMP (Technical Review and Update of Manuals and Publication) and ADPREPS (Automated Document Preparation System) deal respectively with the conversion of existing manuals to film, with subsequent automated updating, and the preparation of new technical documents for ultimate publication by NPPS in paper or micrographic form.

Examples of the benefits to be achieved by an automated Navy system are provided by examining recent trends in communications, storage, processing and printing. Transmission rates, which in the 1960s were at most 12.5 million characters (100 million bits) per second (digital, via coax cable), can now achieve 1000 times this rate (12.5 billion characters) using coherent light, and the number of available channels has increased over the same period from one

thousand to ten million (see Exhibit 2). Comparable improvements have occurred in the other areas; non-impact printers, for example, can output over 18,000 lines per minute. Even more important in the context of Navy publications is the versatility exemplified by the Xerox 9700 Electronic Printing System, which has a monthly production capability in excess of one million copies and provides multi-font composition capabilities.

The anticipated usage levels of non-impact printers over the next twenty years⁹ (see Exhibit 3) reflect the driving force for automation and demand printing. This is even more strikingly demonstrated by surveys of the library and publisher community which indicate their belief that 50% of all technical reports will be published in machine-readable form by 1997 (see Exhibit 4)¹⁰.

In summary, the establishment of an automated publishing system within the Navy in terms of an electronic text processing/graphics communications network with an accompanying management/monitoring "meta-system" should achieve the following benefits:

- o significantly improve responsiveness to all types of publication needs
- o reduce administrative burden on fleet units
- o provide significant cost reduction
- o provide secondary benefits from the concurrent establishment of automated data bases of Navy publications

The feasibility of accomplishing these improvements is demonstrated in the main body of this report.

3. Proposed NAPS Concept

3.1 Introduction

A successful approach to problem solving has historically incorporated the establishment of firm goals prior to describing the steps necessary to the achievement of those goals in a given period of time. This was true for the development of the Polaris missile submarine and for the space program. Similarly, the concept provided in this report for a Navy Automated Publishing System (NAPS) was developed as a means of accomplishing the publication of all Navy non-tactical information (including for example administrative, financial, maintenance, training, supply and procurement functions)

EXHIBIT 2

Advances in Applicable Technologies

	<u>1968</u>	<u>1978</u>	<u>Reference</u>
Transmission rate (characters/second)	12.5 million	12.5 billion	(Appendix B, p. 106)
Available transmission channels	1,000	10.0 million	(Appendix B, p. 107)
Magnetic storage capacity (characters)	200 million	2.0 billion	(Appendix B, p. 64)
Costs of magnetic storage - head per track (cents/bit)	.1	.04	(Appendix B, p. 56)
Cost of processing (dollars per 100,000 calculations)	.05	.0008	(Appendix B, p. 19)
Speed of processing (operations/second)	80,000	2 million	(Appendix B, p. 28)

EXHIBIT 3

PERCENTAGE OF ELECTRONIC PRINTER COPY VOLUME PRODUCED BY VARIOUS TECHNOLOGIES

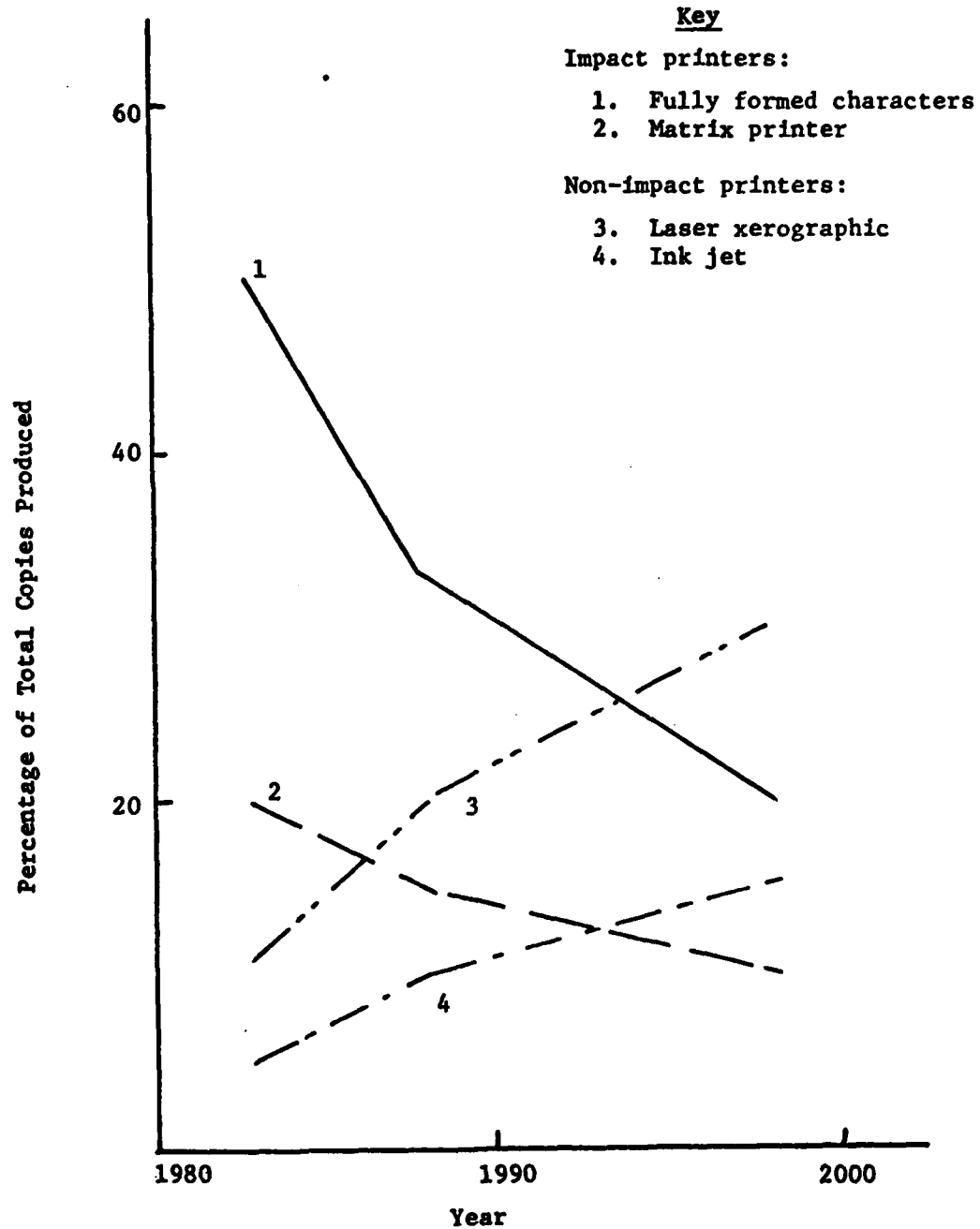
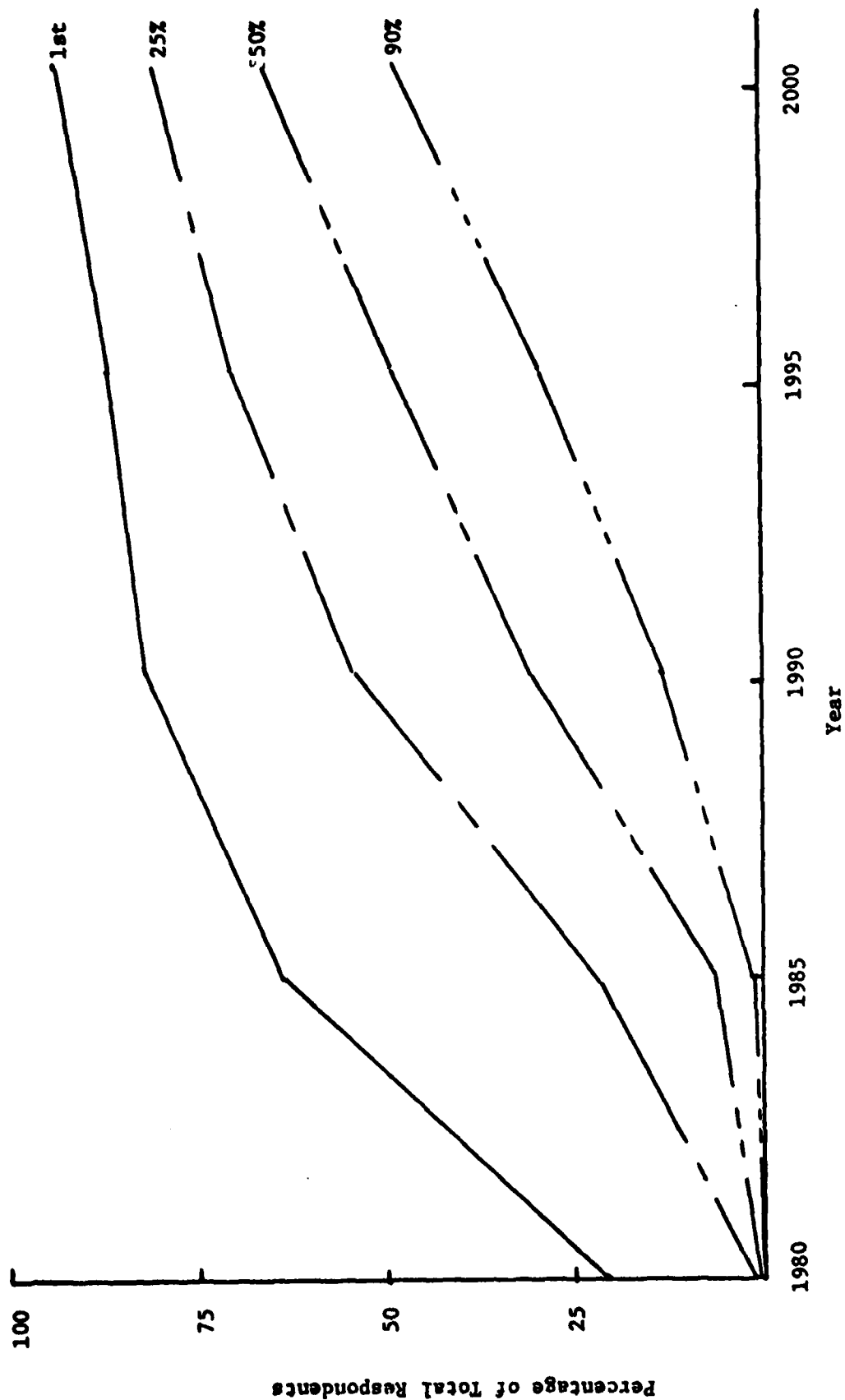


EXHIBIT 4

SURVEY RESPONSES CONCERNING PERCENTAGE OF TECHNICAL REPORTS PRODUCED IN MACHINE-READABLE FORM



by the year 2000. Once this concept has been formulated as a goal, the steps necessary for its achievement can be assessed in terms of the state-of-the-art (SOTA) in applicable technologies and current capabilities, and the expansion/developments needed in both areas to close the gap in incremental fashion between anticipated requirements and projected improvements in service.

To accomplish the task of specifying the sequential upgrading process in detail, it will be essential to establish a solid basis of requirements data. The present lack of such quantitative information, however, does not impede concept formulation. Use of a distributed systems architecture permits expansion/contraction over a broad range of processing loads and allows phased expansion of capabilities without disruption, over the expected life span of the system.

By the year 2000, NAPS is perceived to consist of distributed data bases (of "published" Navy documents), processing capabilities, and multi-function user workstations with on-demand printing capability, embedded in a rich communications environment. Its users will include not only NAPS system operators in all segments of the Navy, but Navy management and administrative personnel, and contractors providing documentation to specific Commands. This goal will be achieved in step-wise fashion, building upon specialized current capabilities such as TRUMP, ADPREPS etc. for composition, and initially utilizing NPPS field plants for reproduction. At present, decentralized document production activities are available on a local basis only. The next stage, achievable within one or two years, will enhance the existing system by means of "black boxes" to interpret input data prepared by word processors, and ready it for output via the Xerox 9700, in conjunction with the use of digital facsimile and limited communications capability. By 1990, there will be decentralized, on-demand printing and publishing services, using electronic data bases consisting of published Navy documents, possibly located at each local NPPS office. Forms and, possibly, periodicals may also constitute part of the data base. Communications capability will allow simultaneous and immediate production at many sites, eliminating the cost in dollars, space and manpower resulting from extensive stock-piling. Ultimately, the "job shop" orientation

of NAPS will gain significant efficiencies and economies of operation far beyond current capabilities due to the combination of the NAPS production system and its associated management monitoring "meta-system".

The following paragraphs provide an overall description of the system perceived for NAPS 2000 (see Exhibit 3) and a brief discussion of the necessary steps to achieve that goal.

3.2 NAPS 2000

3.2.1 Introduction

A major problem in today's publishing activities is the necessity for separate handling of textual and graphic materials. Most of the technological improvements which have already been introduced into the industry focus upon text editing and text manipulation. Improved capabilities for graphics handling are beginning to be introduced for special-purpose applications, however, and eventually both types of material will be processed simultaneously. The trends in these two categories are separately discussed in the following subsections.

3.2.2 Text Handling

In the year 2000 most textual information entering the NAPS system will be captured at the originator's keyboard which is an integral component of an input/output terminal. This unit will contain sufficient processing capability and storage to permit an operator to perform his job to his limit of ability. Once a segment of input has been processed, it can either be stored locally or transmitted to the appropriate NAPS storage unit. In conjunction with the keyboard inputting of text, voice input will be employed extensively, not only for initial drafting of documentation but also for the editing function. Tables and other listings, if not prepared via a keyboard, will be entered by an optical character reading mechanism, the choice depending upon the form in which the data exist.

By the year 2000 most large and probably many medium-sized organizations will have available in some form broadband loop media (probably fiber optic or coaxial cables) for local communications. These loops will optimize the cost of systems, since a central

processor incorporated in the loop will be capable of performing many more operations than any one application could require. Thus the local communications link at a site will multiplex the information being entered from a large number of individual terminals.

The local processing which will support the inputting of information via the terminals (beyond and above the processing capability resident in the terminal) will be provided by extremely powerful outgrowths of the current microprocessor developments. These systems will be very small in size, will have tremendous computational and data manipulation power, and will provide extensive overhead and bookkeeping support to each of the user terminals. By the year 2000, these processors will not be uniquely dedicated to word or text processing but will support any form of processing that the user demands, including "image" processing as described below.

The word and text processing functions incorporated into the generalized processor support capability will be, in general, transparent to the user. That is, the user will not be aware of how the processor manipulates the data entered, nor be concerned about any ancillary functions, unless he commits an error which is identified by the system via a message to him through the terminal (display device).

The information entered by keyboard will be manipulated/processed on a character-by-character basis; however, once composed, a full page will be stored as an entity or image, capable of being recalled, modified, updated or erased as required by those editing and monitoring the production of the document.

Available communications will include not only terrestrial but satellite links, and will permit the transmission of massive amounts of information in very short periods of time. Since the basic storage mechanism will retain an image as a single entity, transmission of that image via these broadband capabilities will permit economical and efficient utilization of the communications environment.

Since the NAPS system will be required to operate during times of hostility, as well as in peacetime, a support or backup system will be essential, particularly for the fleet and those bases located outside the continental confines of the United States. This backup

capability will be provided by an image storage mechanism, probably an advanced version of a video disk as currently envisioned. These disks or image storage media units will be prepared or tailored, taking into account the specific needs of each designated user. Thus in the event of hostilities and the loss of direct communications channels, or in the event that the channel becomes clogged, the user will have a fall-back capability.

Navy personnel (either civilian or military) will be the heaviest user of the NAPS output capability. In the year 2000 the predominant method of accessing information from the system will be via soft display devices. This in turn will require, for many applications, high resolution display devices, probably not cathode ray in nature. Many implications will require multi-color capability and "microscoping" of portions of images such that the fine detail will be available when and if required by the user.

The second form of output support will be hard copy, provided by a full range of electronic page printers wherein an image can be transferred from the storage system to the printing mechanism and conveyed to paper for use as required.

An additional form of output will be audio in nature; that is, the system will provide a human-like voice to support the materials being shown on the screen as well as being printed by the electronic page printer. The combination should synergistically provide significantly higher transfer rates of information to the user than would result from the utilization of any single medium.

The processing of text information and its storage, transmission and utilization in the year 2000 will provide the Navy with a significant financial savings once the system is operational. The system will be designed in such a fashion that it will be capable of incorporating individual improvements in any segment of the system and thus be a living and growing system.

3.2.3 Graphics Handling

The handling of graphics in an automated publishing and dissemination system is much more complex than the handling of textual material due to the nature and diversity of the materials classified as graphics, which include not only simple line drawings

and sketches and large engineering drawings (usually requiring very large pull-out sheets in any report), but also half-tones and photographs. Each of these categories requires special handling today. In the year 2000, as the integration of image acquisition, transmission, storage and display becomes available, it will matter very little what form of graphic material is being processed.

The entry of graphics in the year 2000 into the NAPS system will occur in one of two forms. Simple line drawings as well as complex circuit diagrams will be generated by the individual inputting the information on-line utilizing a graphic terminal. The information, once constructed and reviewed for accuracy, will be processed and stored.

The second form of entry will be through an image entry device which will "acquire" as a single entity the drawing previously generated by a human. Once the information has been acquired it will be transmitted, by fiber optic or equivalent communications, to a NAPS processing site. Here information associated with the particular image will be appended logically prior to storage. Any future processing associated with the image will be performed utilizing the same type of graphic terminal previously discussed.

One of the major advantages to the storage of an image will be the capability of the user not only to recall the full image, but to amplify or "microscope" portions of that image for finer detail and greater resolution. This microscoping capability will be made possible by appropriate software. Thus, an individual concerned with an engineering drawing of a particular piece of equipment will be able to focus his attention upon any subportion of that drawing if need be. The hardware and multi-media capability will also permit the incorporation of motion of the display, and the use of customized instruction aids such as cartoon figures or highlighted portions of the display field.

Finally, it is conceived that fiber optics cables will permit the user to "extend" the face of the display terminal as he operates on a piece of equipment in such a fashion that, although the terminal may be located on a workbench, the actual display will be available to the user in any portion of the area he is assigned, and in any

orientation necessary for his convenience.

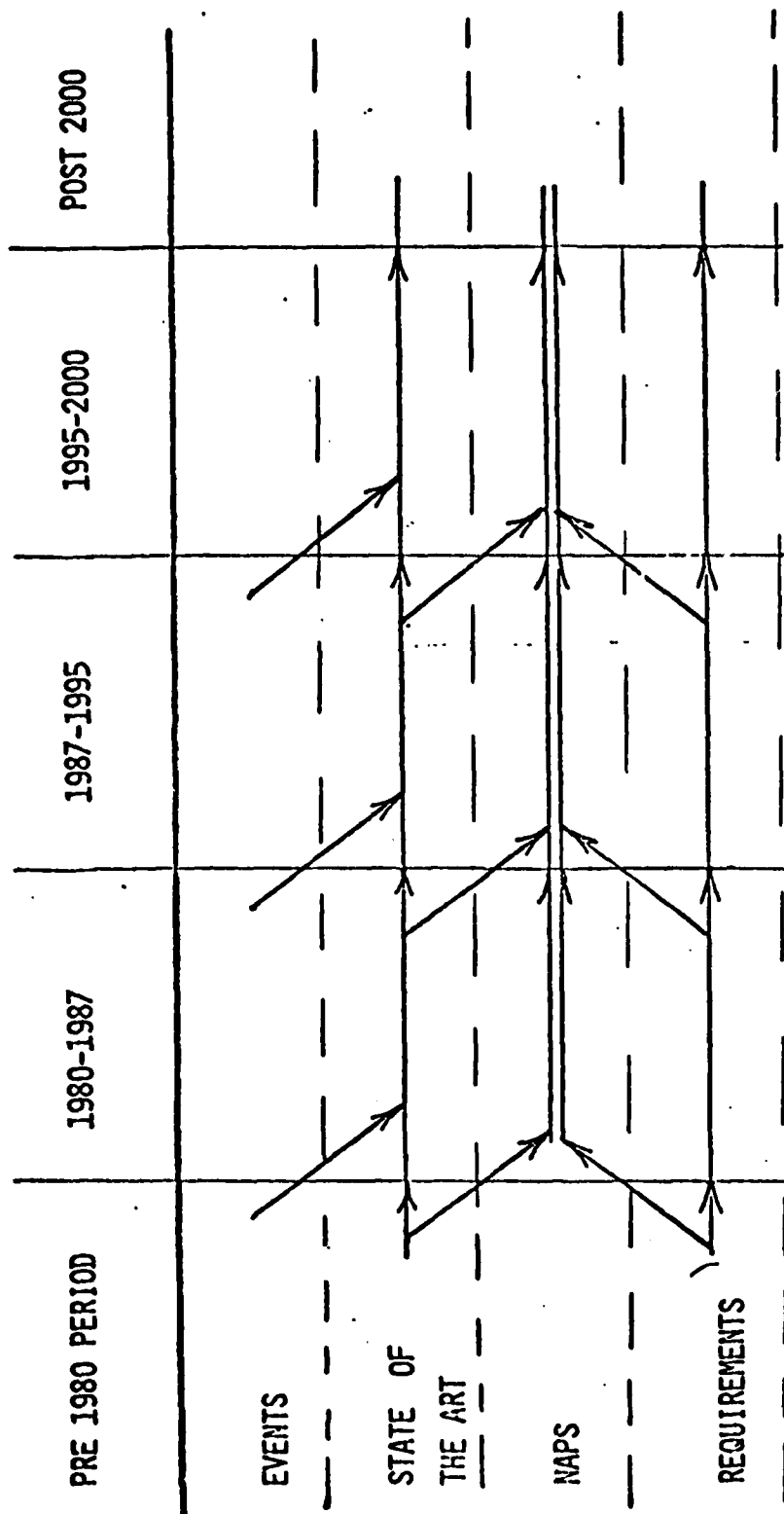
3.3 The Route to NAPS 2000

3.3.1 Introduction

The conceptualization of NAPS-2000, as described in the preceding section, focuses upon the technologies that will be employed to perform the critical functions associated with entering, manipulating, storing and displaying information. The ability to focus upon these technologies in this qualitative fashion is the result of a very detailed analysis and forecast which is presented in Appendix B of this report. The fundamental principle underlying the forecast is that the inertias which are already operative in the information processing, communications and printing/publishing industries will continue to be operative during the next 20 years. Obviously, some of the quantitative forecasts may become less reliable as time moves out from our vantage point of today. However, the incorporation of a set of potential events, obtained from various surveys (see Chapter 5), provides us with an increased level of assurance that the NAPS system will not only meet the requirements of today, but will be capable of incorporating new developments as they occur to provide the expanding levels of performance necessary for the future. Exhibit 6 indicates the manner in which the evolutionary improvements contribute to the development of NAPS.

It is extremely important that the managers who are directing this development understand that the system is not a static system to be implemented at one point in time, but will be constantly changing and expanding in capabilities. Consequently the monitoring function must include constant surveillance of R&D being performed both within governmental laboratories as well as by industry.

With the generation of the master plan for the conceptualization of the total NAPS system and the identification, within that plan, of key technologies which may be applicable and required as a base, the management monitoring operation must be capable of making decisions as to when and where to incorporate new developments for the system's growth and expansion. For example, the development of higher resolution terminals for soft display of information will continue in industry and will probably require very



IDEALIZED INTERACTION AMONG EVENTS, STATE OF THE ART
REQUIREMENTS AND NAPS

EXHIBIT 6

little impetus from either the government as a whole or the Navy NAPS program specifically. On the other hand, such developments as fundamental research in image processing and image transmission techniques may very well require specific encouragement by the NAPS team such that those developments will occur in a timely fashion in relation to the master NAPS plan.

To summarize, NAPS as conceived is a very complex system and will require the utilization of the most advanced and cost-effective components available. Thus the monitoring of the industry in general, and R&D products specifically, will be of major significance in its own right.

3.3.2 Input

The development of voice input techniques for use with computers is one of the more important technologies which must be monitored. Developments are currently underway and it is expected that these developments will progress, on their own, in such a fashion as to provide NAPS with sufficient capability to meet its requirements for this type of input during the mid-to-late 1980s. On the other hand, the development of image acquisition input techniques does not appear to be adequately funded nor staffed at present. A careful examination of the state-of-the-art in image acquisition/input techniques should be undertaken at the earliest possible date.

Other input techniques not associated with the man-machine function, such as the acquisition of the large massive "data bases" which already exist in the forms of manuals, operational instructions, forms, etc., require specific attention. We do not expect that the image acquisition input techniques (discussed above) will be available to provide for the insertion of these documents and forms into the NAPS system data base. Therefore, alternate approaches will be required.

3.3.3 Processing

The development of information processors (mainframe and mini- and microprocessors), funded primarily by the commercial marketplace, is currently advancing at a pace more than adequate for the forecast needs of NAPS. On the other hand, NAPS will have to examine and

probably fund significant software developments to provide unique capabilities required by the Navy Automated Publishing System. Specific to these developments will be the generation of a multi-processor, distributed operating system which, if possible, will incorporate security techniques as well as unclassified information in the same system. If an adequate level of assurance of security cannot be obtained, then a subsystem of NAPS will have to be designated to handle, process and disseminate classified information.

Not only will the NAPS system require a unique operating system, but in all probability the data management system and its subcomponents will also require either a unique implementation or significant tailoring of commercial packages. Thus, the examination of the data management problem presented by a system which will be required to store such massive amounts of data must be examined in great detail. In addition, the implications of image storage and the ability to update images, as opposed to dealing with individual characters or strings of characters, must be conceptualized and carefully evaluated.

Finally, a very extensive array of hardware handling software packages will also be necessary. Most of these should be available from commercial sources. Once again, the organization responsible for monitoring developments in the commercial and governmental laboratories must be constantly aware of what is being done, and what is not being done, such that the needs of NAPS can be addressed in a timely fashion.

3.3.4 Mass Storage

Again, as in the discussion of processors, the developments in this area are producing higher density equipments at a rate adequate for the NAPS implementation effort. One of the reasons for this is that the conceptualization of NAPS permits a large number of individual sites, and thus the number of units employed may vary depending upon the requirement presented to NAPS at any one time.

The development of video disk systems must be carefully monitored since they should form the basis of an image storage capability envisioned for the period beyond 1990.

3.3.5 Communications

NAPS will require extensive communications both in the continental United States as well as to overseas installations and ships at sea. During peacetime it is anticipated that a limited number of satellite communication links will be developed and made available. However, the communications environment for NAPS will include not only the more exotic forms of communication such as satellite links for ship to shore paths, etc. but all conventional means of communicating digital data. Local loops will provide the multiplexing capabilities at various installations since their use will significantly reduce the overall cost of the NAPS system by allowing time-sharing of processing, storage and communications control units. This is already being done on an experimental/local basis.

The utilization of satellite broadband techniques for dissemination of informational instructions and subsidiary materials should also be examined. Again, the commercial efforts in this area by large corporations such as General Motors, the aircraft/space industry, etc. may provide significant capability which will not require additional funding from the NAPS program.

If the NAPS system cannot incorporate into a single entity the handling of classified and unclassified materials, the development of a secure communications network for the classified subsystem will be required.

3.3.6 Output

The development of high resolution display units is already underway. The cost of these units, however, is high and NAPS may be required either to develop alternative approaches or to encourage the development of lower cost high resolution display units of a non-conventional nature. It is highly probable that high resolution display units will become available, probably during the latter half of the 1980s; however, the need for these units must be addressed by the NAPS monitoring team at an earlier date. Alternative approaches can be examined; for example, a software implementation might be possible. Tradeoff studies would be appropriate in this area.

The second output method which requires careful consideration is the utilization of audio output based on voice synthesizers as an

integral part of the NAPS system. Here there can be many benefits to the user if the system can properly implemented. Certainly significant strides are being made in voice synthesizers at this point in time and a thorough examination of that area appears to be warranted.

4. Conclusions

Printing and dissemination of Navy documentation is growing at an ever increasing rate, with resulting increases in cost and decreases in efficiency. The exact dimensions of the problem are unclear due to a lack of hard data which is consistent across all categories of printed materials. The application of advanced electronic data processing and communications technologies with their concomitant increase in productivity can be of significant benefit in providing the Navy with responsive and cost-effective publishing services. The current state-of-the-art in these technology areas, and the improvements forecast for the next twenty years, are and will be sufficient to permit the design and implementation of an automated system which will constitute an efficient electronic chain for the production, publication and dissemination of all Navy non-tactical information. The design and implementation of such a Navy Automated Publishing System must take into account not only today's requirements, but those of the time-period 1980 through the year 2000. In this way, a specification can be generated which will allow the system to grow and expand (or contract as necessary) in extent and capabilities during the time-frame of its postulated existence.

Based upon the initial effort to conceptualize such a system, the following specific conclusions can be drawn:

- o No useful categorization scheme exists today for Navy publications which can be employed as a basis upon which an accountability structure can be built, and which is essential to a detailed system design for NAPS;
- o The lack of enforced input and output standards concerning formats and structure of documents, instructions, forms, etc. is one of the root causes of a significant inefficiency in Navy publishing and printing;
- o The Navy Publications and Printing Service is tasked with providing printing and related services to the Department of the Navy and is the Navy's central printing and

- o publications management organization. While NPPS is not presently configured to develop, manage and operate the future NAPS system in a fashion which will provide the types and extent of services necessary, these are appropriate functions for it to undertake.
- o The Navy already possesses a variety of uncoordinated, Command-specific experience and expertise in automated composition and other printing, publishing and distribution functions.
- o The rate of growth of the current state-of-the-art in both the electronic data processing and communications technologies can provide all of the critical elements required to design, construct and place into operation the contemplated automated publishing system. However, a master plan for the development of NAPS is absolutely essential since various developments are currently underway which, if not properly phased and integrated, would lead to a series of non-compatible, individual, diverse system.
- o The requirements posed for a NAPS system and the rate at which the technology is growing makes it almost mandatory that a distributed system be designed. This will be of major benefit to the Navy, allowing for flexibility in the total capacity and performance levels. The distributed network concept for NAPS will be capable of significant expansion or contraction, and the rolling infusion of appropriate new technologies and skills as they mature.

In conclusion, it is obvious that the Navy cannot continue to handle its publishing and printing workloads in the current fashion. Developments in high technology are moving very rapidly and their utilization in the design of a Navy Automated Publishing System is logical and can contribute significantly to increased productivity, and to improvement in the efficiency and effectiveness of the fleet at sea as well as the shore personnel.

5. Recommendations

a. General

- o As the cognizant central organization for Navy printing and publications management, it is appropriate for NPPS, in addressing its goal of providing responsive and cost-effective publishing services to the Department of the Navy, to take the lead in designing, testing, implementing and managing an automated system to coordinate and accomplish Navy publication services, as outlined in this report.

- o The Navy Automated Publishing System (NAPS) should be introduced incrementally over the next twenty years to achieve a rolling infusion of advanced technology and skills appropriate to meeting the Navy's publication needs in the year 2000.
 - o While automation is the primary focus of the recommended development program, this should be accompanied and supported by activities in the areas of standardization of input and output, regulation, management and training/education.
 - o Analysis of publication-related problems indicates that the optimum configuration for NAPS will incorporate a distributed system of data bases, processing and printing facilities, embedded in a rich communications environment. The emphasis will be upon the provision of user multi-function work stations, with a gradual shift towards a balanced mix of soft display capabilities and printing on demand.
 - o The most appropriate implementation strategy for NAPS will incorporate Navy management, and joint Navy-industry staffing and equipment ownership. Detailed cost benefit analyses should be undertaken prior to precise determination of interfaces and decisions concerning for example lease vs. buy, dedicated vs. time-shared equipments and services.
- b. Specific
- o A comprehensive categorization schema for Navy non-tactical information should be developed, and adopted by NPPS for quantitative workload assessment.
 - o An aggressive program must then be initiated to define the extent and volume of the various categories of publications to be affected by the implementation of NAPS.
 - o Once these requirements are established, the normative system (NAPS 2000) should be specified in quantitative form in sufficient detail for a life-cycle cost-benefit analysis to be performed.
 - o Alternate implementation strategies for NAPS should be defined in sufficient detail to permit comparative cost-benefit analysis, and selection of the preferred option.
 - o Alternative methods of funding the NAPS program in both the short and long term should be examined, and decisions made as to the optimum approach.

- o The Navy R&D program for Automated Graphic Sciences should be expanded to pursue the NAPS concept. Duplication of industry efforts can thereby be avoided (by monitoring) while building up necessary in-house capabilities. We suggest that the most effective approach to the accomplishment of the NAPS R&D program would entail the following initial actions:
 - 1) Short-term Orientation: Establish a panel of operational NPPS personnel to rule on all procurement requests for publishing and printing equipments, from whatever source, to ensure compatability/interface with the NAPS concept.
 - 2) Mid-term Orientation: Establish a panel similar in composition to the Navy Publications and Printing Policy Committee, including NPPS personnel, consultants and ex officio representatives of NAVSUP and other Commands as deemed appropriate, to review on a regular basis all problems arising in areas appropriate for AGS-program funding, potential projects relating to the solution of such problems, and the progress of on-going AGS projects, to establish priorities among these various efforts, and to identify any migration from the 6.2 to 6.3 funding category.
 - 3) Long-term Orientation: Initiate a System Development Plan (SDP) for NAPS. The SDP is a planning and funding schedule procedure defined by the Department of Defense in response to OMB circular A-109, and embodied in directives 7920.1d and 7920.2i. It is anticipated that this procedure will shortly be adopted by the services. Because of this, to achieve the orderly and timely evolution of NAPS, it is recommended that NPPS follow this approach in order that requisite levels of 6.2 and 6.3 funding can be determined and appropriated for associated activities. Speed is essential in moving into the lengthy SDP cycle to identify appropriate technologies, prototype efforts, and test bed applications and sites.
- o Testbed sites/applications should be identified and thorough requirements and implementation schedules generated. These sites/applications should be as self-contained as possible to assure:
 - 1) Success in identifying the requirements
 - 2) Design of the initial implementation

3) Placing the application into operation.

Site application selection should take into account:

- 1) Impact of success upon the operation of the Navy, NPPS and the specific site selected.
- 2) The negative consequences of failure not only upon NAPS but upon the selected site and all those relying upon that site for day-to-day operations.

It is anticipated that initial selection will include one or more of the NPPSO facilities which support SPCC, NPFC and CNET. It will also be advisable to develop in-house evaluation facilities, such as the contemplated Graphic Arts Testing Center, and on-site test beds for projects such as ADOPS (Automated Document Production System) currently being evaluated by the Fleet Combat Direction Systems Support Activity.

- o An essential ingredient of NAPS is the logical integration and interfacing of many data bases, which currently exist as independent entities, to facilitate source data capture, up-dating, file coordination and many management-oriented activities. NAPS system monitoring will be embodied in a meta system which will either interface with, or subsume, PRMIS. Further, the meta system must be capable not only of monitoring the various subcomponents of the NAPS system itself, but also of communicating through standardized procedures with such organizations as BuPers, BuMed, etc. One consequence of this integration is that activity at one data base would trigger up-date functions at other sites. NPPS should initiate an examination of all data bases (through or in conjunction with NAVDAC) to identify the sequence in which the automatic interfacing should be undertaken. Problems of compatibility of data structure, control procedures and protocols must be identified and methods of overcoming incompatibility formulated.
- o The NTIPS concept (Navy Technical Information Presentation System) resulting from the on-going study commissioned by DTNSRDC, comprises six major subsystems: definition/acquisition; technical content generation; mastering/replication; distribution, delivery and control, all relating solely to technical information. For optimum satisfaction of the Navy's information needs, at least the mastering/replication and distribution should be "folded in" to the NAPS effort.

THIS PAGE IS NOT QUALITY REPRODUCIBLE
FROM COPY FURNISHED TO JWC

- o The structure and mission of NPPS and other Navy activities providing a publishing function should be reviewed and if necessary revised to adjust to the capabilities of NAPS and the needs of the Navy.
- o A survey and/or an evaluation of formats, styles and report/form structures employed both within the Navy and by contractors must be performed as a preliminary step towards the establishment of input and output standards.
- o A careful review of OMB, GSA, Executive Orders from the Office of the President of the United States and other agency regulations and rulings should be undertaken to determine their impact, if any, upon the development, implementation and operation of NAPS in the period 1980 through the year 2000.
- o An examination of both the current legislation issued from the Joint Committee on Printing as well as the statutes governing the Freedom of Information must be examined in the context of the storage and dissemination of personnel information.

6. References

1. Briefing on NTIPS (Navy Technical Information Presentation System) by Sam Rainey, Program Manager, DTNSRDC, to James L. Cherny, Director, NPPS, May 3, 1979.
2. Projection of Navy computerized records, cited by Daniel Gacek, NPPSMO.
3. Productivity in the Federal Government, Staff Study prepared for the use of the Joint Economic Committee, Congress of the United States. USGPO, Washington, D.C., 1979.
4. Frazier, Thomas W., et al., Implications of an All-Digital Navy Technical Information Presentation System, Final Report, Contract # N00019-78-C-0175, Behavior Technology Consultants, Inc., July 1979.
5. A Field Survey of Electronic Maintenance Technical Data, Aerospace Medical Research Laboratories, AFSC, November 1967.
6. Better Information Management Policies Needed: A Study of Scientific and Technical Bibliographic Services. Report to the Congress by the Comptroller General of the United States, PSAD-79-62, U.S. General Accounting Office, August 6, 1979.
7. "Information Processing and the Office of Tomorrow",

prepared as a White Paper to Management by the International Data Corporation, and published as a special supplement by Fortune (Waltham, Mass.: IDC, 1977).

8. An Automated Publishing System for the Naval Education and Training Command, TAEG Report No. 50 (Orlando, Fla.: Training Analysis and Evaluation Group, October 1977).
9. Hard-Copy Output in the Future Office Environment (Cupertino, Cal.: Dataquest Inc., July 1979).
10. Lancaster, F. W., publication pending.